PATENT
Attorney Docket: Jakobson 6

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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| Inventor: | Jakobson et al. | |
| Serial No.: | 09/387,961 | Group Art Unit: 2872 |
| Filed: | September 1, 1991 | Examiner: Nelson Moscowtiz |
| Title: | AN APPARATUS AND METHOD FOR MAKING AN OPTICAL FIBER AMPLIFIER | |

Honorable Asst. Commissioner of
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Patent and Trademark Office
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Sir:

**DECLARATION UNDER 37 C.F.R. § 1.131**

Paul A Jakobson declares as follows:

I am one of the co-inventor of the subject matter disclosed and claimed in the above-identified application.

I currently hold the position of Manager, Product Engineering and Reliability.

Since 1982 I have been active in the research and development of optical fiber design and manufacturing.

I received my B.S. degree in 1981 from Imperial College, University of London, in Physics.

I, together with my co-inventors Edward Murphy and Todd Withal, conceived of the invention at a date earlier than April 6, 1998 (the filing date of the US 6,134,047 reference), as evidenced by the attached copies of the internal Invention Disclosure memo. Please note that certain proprietary information has been deleted from these copies. The date of the Invention Disclosure memo was prior to April 6, 1998.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under

Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Paul A. Jakobson

Date: 7/8/02

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| INVENTION TYPE | CURRENT STATUS | Yes | No | EXPERIMENTAL WORK IS: |
|---|---|---|---|---|
| ( ) Composition | - Tested for Properties | ( ) | ( ) | (x) In Progress |
| (x) Product | - Prototype Produced | ( ) | (x) | ( ) Suspended |
| (x) Apparatus | - Assembled and Operated | ( ) | (x) | ( ) Completed |
| (x) Process | - Has Been Demonstrated | ( ) | (x) | ( ) Completed |

COMMERCIAL FOCUS: Specify the Division (e.g. TPD, R&D OR M&E) and product line (if any) which would have the primary interest in this invention.

Divisio.. _____ Product Line Amplifiers

Business Team/Department Development/Manufacturing

RELEVANT RECORDS: Identify notebooks, reports or memos which refer to this invention.

Has the invention been sold or offered for sale? No (Yes/No) _____ (Date)

Has the invention been disclosed to anyone outside Corning? No (Yes/No) _____ (Date)

DESCRIPTION OF INVENTION: Write and attach a description of your invention. Start with the Background of the Invention, i.e., to what area does it relate and what problem does it solve. Then, provide a sufficient description of the invention, including drawings if appropriate, so that someone not familiar with the invention will understand what it is, how it works, and how it solves the problem.

Signatures:

#10

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What we propose is a solution to this manufacturing situation using pluggable amplifier submodules.

Proposed Invention

We propose as a solution to this manufacturing problem, that would also aid in faster development and prototyping, that amplifiers be broken down into submodules (possibly with pluggable, board mounted connectors) and that the submodules can be used over again in different amplifiers.

As an example of this, if one examines the four amplifiers, in Figure 1, 2, 3 and 4; one sees commonality of parts and functions in these different amplifiers. An algorithm can be defined to create the submodule boundaries. Figure 5, 6, 7, and 8 show the submodule boundaries for the Line, In and Out amplifier (where there are two versions for the In amplifier; one with 14 dB net gain, Figure 2, and one with 9 dB net gain, Figure 4).

The algorithms for creating the boundaries are as follows:

1. As per Figure 10, locate all like and unlike fiber splices. In Figure 10, the splices are labeled. Focus first on the erbium to 28 splices. One of two actions should occur:
   - The adjacent component downstream to the erbium should be fabricated with fiber on its input port resulting in an splice or interface.

or

   - A strong low loss splice to SMF28 should be made to the erbium fiber.

When this is done for the amplifier of Figure 10, the resultant splice interfaces are then shown in Figure 11.

1. Locate the input and output components of the amplifier (either before a 980/1550 WDM or after an erbium/28 strong splice). This junction creates submodules A and B as shown in Figure 5.

2. Locate other components that are desirable to have as plug-in modules due to reliability considerations or design/flexibility considerations. This will define the 980 pump submodules labeled D in Figure 5.

3. Locate the G3/G3 splices and the components that effect amplifier gain and gain flatness on a separate submodule. This creates submodule B in Figure 5 and is useful as a submodule because, if changed along with pumps, could permit a completely different amplifier at different gains and output powers for different applications (i.e., making use of the submodule concept).

4. Locate any other common components between various amps. This creates a submodule E and E′ as shown in Figure 9. This also applies to submodule A, B and C.

5. Locate any submodules that need a minor change (one or two components) that then permit a totally new amp. An example of this is the 9 dB net gain In amplifier required by Tellabs. This is an input amplifier at 9 dB net gain vs. the 14 dB net gain of the normal input amplifier. This lower gain amplifier is shown in Figure 4 and is the same as Figure 2 except that the erbium gain is lower resulting in a different length of erbium fiber and a new gain flattening filter is also required because of the large difference in gain. This becomes submodule B′.

The input and output interfaces between submodules is important. A preferred embodiment of the invention will use board mountable 28/28 pluggable connectors such as the Molex 86061 discussed earlier with low insertion loss (.2 dB typical using standard SMF28 fiber). This permits the modules to plug into each other at final assembly and is a distinct advantage for manufacturing and manufacturing efficiency.

Figure 9 then shows all submodules with the submodule interfaces indicated as follows: CONN G3 is the board mountable connector specially made with Corning G3 fiber, CONN 28/28 is the normal Molex 86061 connector made with SMF28 fiber, and 28/CONN is the (PTD) SMF 28 fiber pigtail that is spliced into modules on one end and has customer specified connector on the other.

envisioned that the assembly of the submodules and the final module assembly plugging in the submodules will be done under a clean room hood. It is envisioned that small, clean room hoods would be available at each assembly bench and at each test station so that we can take advantage of the pluggability concept.

The advantages we see to this invention are:

1. Algorithm for optimizing splices resulting in as many 28/28 splices or like fiber splices (G3/G3) as possible helping submodule interfaces use of 28/28 fiber.
2. Definition and use of submodules that are common among different amplifiers.
3. Assembly and pre-testing of submodules prior to final amplifier assembly. This defines a good, in-spec module prior to final assembly where it (plugged together). This should result in high first pass manufacturing yield and easier test station interface.
4. Use of a board mountable 28/28 connector between all submodules except the pump submodule, which requires a board mountable G3/G3 connector. This is under development with some outside vendors.
5. Use of pluggable pump submodules
6. Ability to more easily locate out-of-spec components or splices and change them quickly enabling faster/easier troubleshooting and rework.